

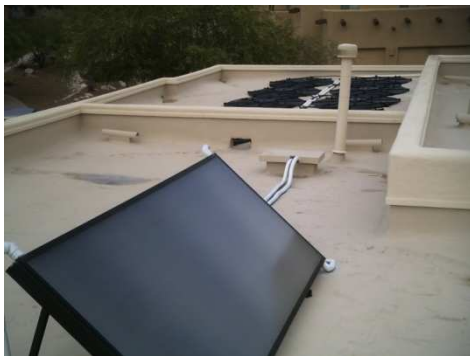


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Selecting/Installing Solar Power Systems

***Joseph DiMatteo - SunPower of
Arizona***



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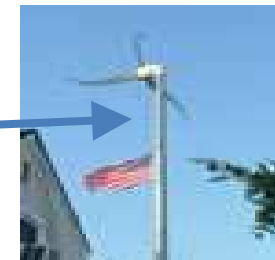
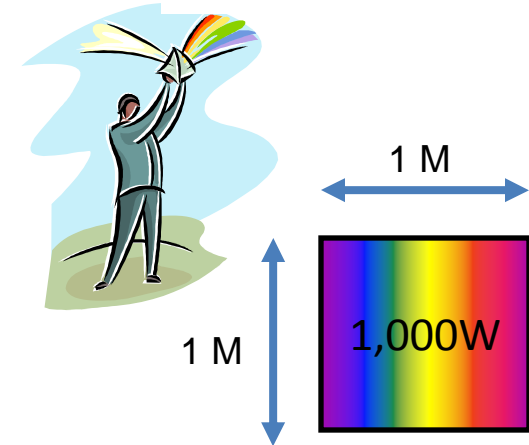


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Solar Basics

- **Sun's Energy Content**
 - Consists of many wavelengths
 - 1,000 Watts per square meter
- **Types of Solar Systems**
 - Solar Thermal
 - Pool Heating
 - Hot Water
 - Solar Electric
 - Wind Turbines



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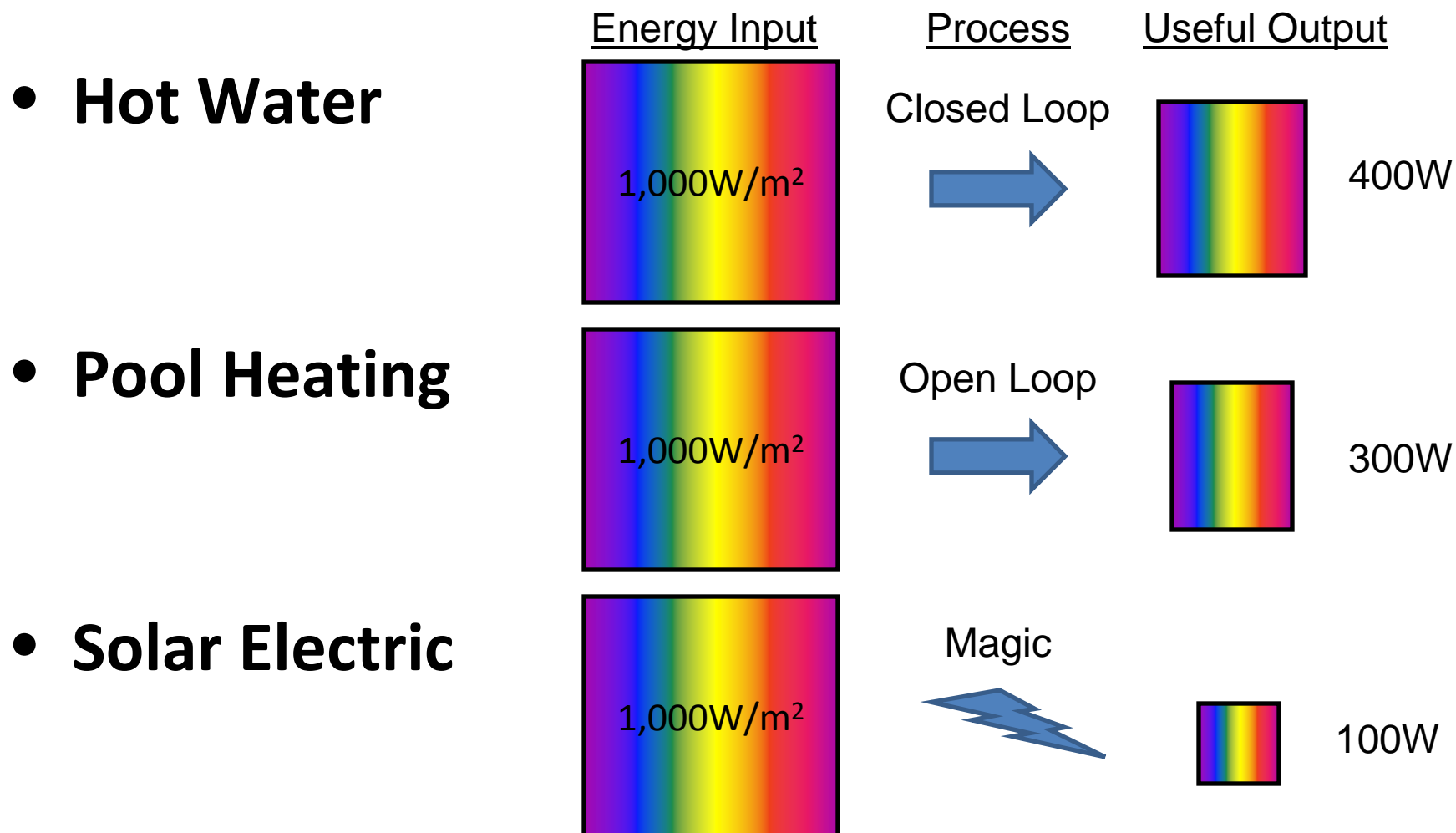
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Solar Basics



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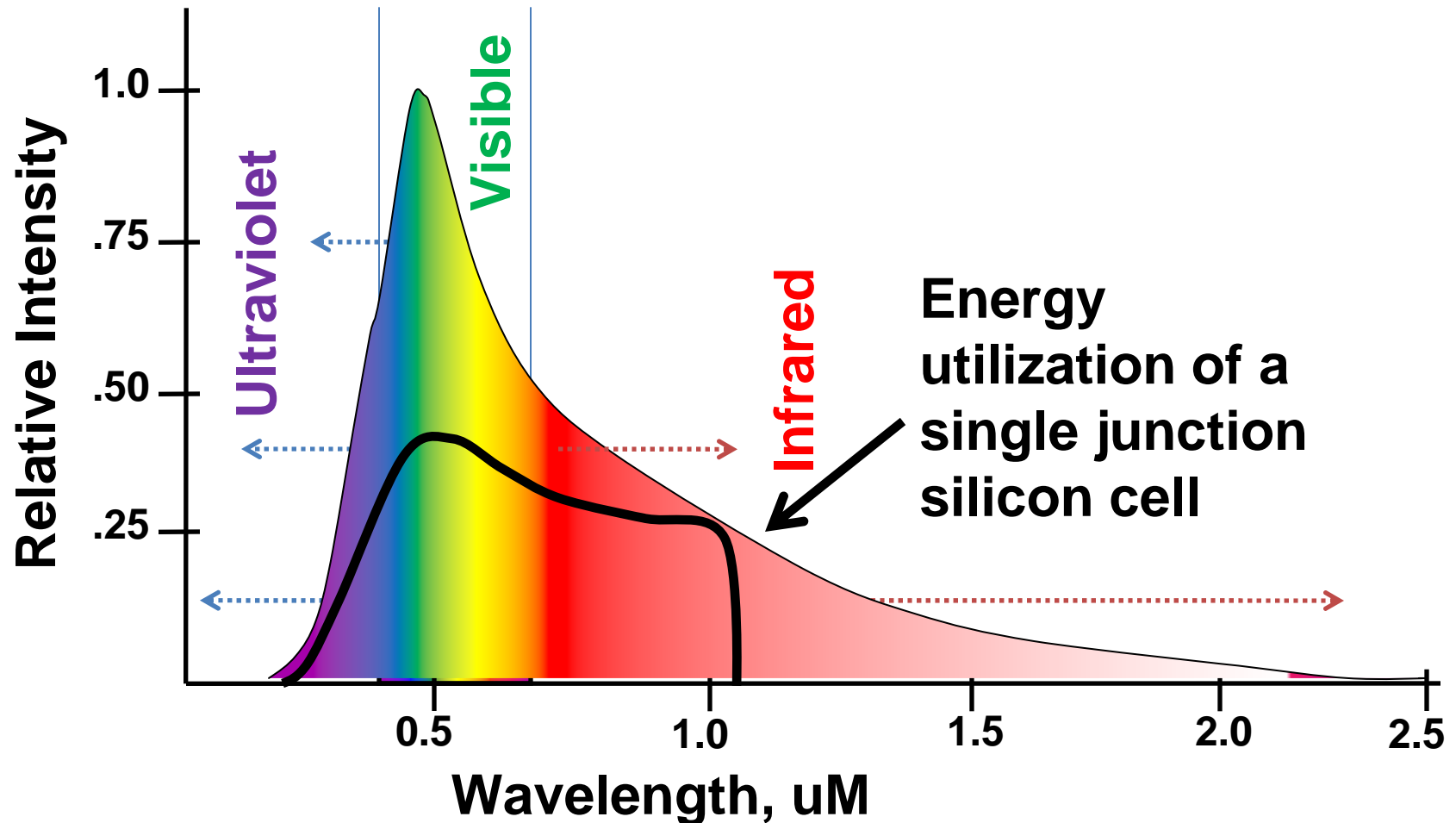
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Solar Basics - Why The Difference?



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Solar Economics

- **Financial Measures:**
 - **Payback versus Return On Investment (ROI)...which is better?**
 - **10 to 20 Year Payback?**
 - **5% to 10% ROI?**
 - **?**
 - **?**
 - **?**
 - **The simple answer is they are the same. Simple Payback and ROI are the inverse of each other. Most people are aghast at the notion it may take 20 years to recoup their investment in solar but many find the prospects of a 5% ROI on their solar investment to be pretty good... How many of your investments are generating a better return than 5% to 10%? How many of your investments are making Arizona a better place?**

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Solar Economics

- **Financial Measures:**
 - **Cost versus Value, i.e. “how much of my investment will I recoup when I sell?”**
 - **Remodeling Cost Recouped: Solar Electric System = 128%**
 - vs. Bathroom 85%, Kitchen 80%, Deck 77%, Sunroom 66%
 - Source: Hanley Wood Remodeling Cost vs. Value Report 2006 Based National Averages for 4KW system and \$155 monthly electric bill
 - **Houses with solar electric systems:**
 - appreciate 62% faster than non-solar homes
 - increase in value \$20,000 for every \$1,000 in reduced annual operating costs
 - Source: National Renewable Energy Laboratory (NREL). Comparative Analysis of Homebuyer Response to New Zero Energy Homes, July 2004
 - **Local realtors: “...houses with quality solar systems sell faster...”**



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Solar Economics

- **Financial Measures:**
 - **Federal Investment Tax Credit (ITC) Extensions effective 1/1/09**
 - 30% per Hot Water and PV system
 - Pool Heating systems do not qualify
 - \$2,000 cap on residential PV credit eliminated
 - Alternative Minimum Tax (AMT) filers can now take credits
 - 5 Year Accelerated Depreciation (MACRS) Schedule for Business Installations
 - **State Income Tax Credit**
 - 25% up to \$1,000 for residential installations (PV, DHW, Pool)
 - 10% for Business Installations
 - **Utility Rebates for PV and Hot Water**
 - Up Front Incentives (UFI)
 - Performance Based Incentives

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Solar Economics

- **Financial Measures:**

- **“Apples-to-Apples” comparison of the options, i.e. “what would equivalent systems cost?”**
 - An attempt to show a comparison of the three main types of systems in terms of an equivalent output in useful energy. Not a practical comparison but it helps illustrate the difference the system efficiencies have on the economics.
- **“Real World” comparison of the options, i.e. “how do I prioritize which practical solar options to invest in?”**
 - A comparison of the economics and performance of three typical systems currently being installed.



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Solar Economics “Apples-to-Apples”

Solar System Type	Approximate Annual Output (KWH/yr in Southern AZ)	Approximate System Efficiency	Approximate Cost <u>Before</u> Tax and Utility Incentives	Approximate Cost <u>After</u> Tax and Utility Incentives (as of 1/1/09)
<u>Domestic Hot Water</u> with (1) 4'x10' <u>glazed</u> solar thermal panel and (1) 80 gallon tank	3,100	40%	\$5,500	\$1,800
<u>Pool Heating</u> with (1) 4'x12' <u>unglazed</u> “plastic” solar thermal panel ...don't try this at home...not practical ☺	3,100	30%	\$1,500	\$1,100
<u>Electric/PV</u> with (9) 3.5'x5.5' 195 Watt panels and (1) 2.8KW Inverter	3,100	10%	\$14,000	\$5,100

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Solar Economics “Real World”

Solar System Type	Approximate Annual Output (KWH/yr in Southern AZ)	Approximate Cost <u>Before</u> Tax and Utility Incentives	Approximate Cost <u>After</u> Tax and Utility Incentives (as of 1/1/09)	Approximate Return On Investment (ROI)
<u>Domestic Hot Water</u> with (1) 4’x10’ <u>glazed</u> solar thermal panel and (1) 80 gallon tank	3,100	\$5,500	\$1,800	15% to 30%
<u>Pool Heating</u> with (10) 4’x12’ <u>unglazed</u> “plastic” solar thermal panel s	31,000	\$5,500	\$4,500	NA...OR... “Phantom 20% to 50%”
<u>Electric/PV</u> with (10) 3.5’x5.5’ 225Watt panels and (1) 2.8KW Inverter	5,000 to 5,700	\$19,500	\$6,800	6% to 12%

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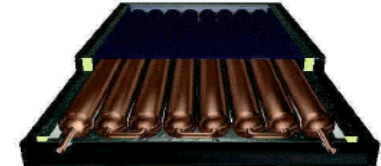


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Solar Thermal Overview

- ***Domestic Hot Water... "Glazed panels"***

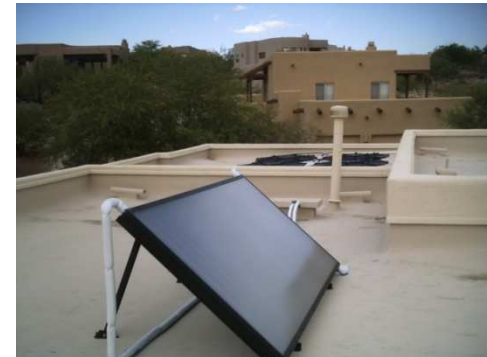


- **Open Loop Passive...**

- no moving parts...60% effective...\$5,500...40 gallon/4'x8' ...600lbs!
- Some risk of freeze damage...low elevations only!!

- **Closed Loop "Glycol" ...**

- pumps, controls...85% effective...\$5,500...
80 gal/4'x10' panel...150lbs
- No risk of freeze damage



- **Closed Loop Drainback...**

- pumps, controls...85% effective...\$6,500...80 gal/4'x10' panel...150lbs
- Minimal damage from freezing

- **Closed Loop Thermosiphon...**

- No moving parts...50% effective...\$6,000...48 gal/3'x7' panel...650lbs!



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Solar Thermal Overview

- ***Pool Heating...400 sf pool..."Unglazed panels or ???"***

- **Flat Roof...**



- Use (10) 6.5' "coil" panels flush on roof → 10-20 year life... \$3,500
- Use (7) 4'x10' rectangular panels on racks → 15-25 year life... \$5,100
- Use (10) 4'x10' rectangular panels flush → Last resort... \$3,900

- **Pitched roof...**



- Use (7) 4'x10' rectangular panels → 15-25 year life... \$3,000
- Little risk of freeze damage if installed properly

- **Other Options...**

- Glazed panel "glycol" system → 25-50 year life... \$10,000
- PV system + heat pump → 25-50 year life*...\$16,000

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Solar Electric Overview

- ***Grid Tie System...hooked up to the utility***
 - Net metering = bidirectional electrical meter + net billing
 - No batteries usually...
 - If electrical grid goes down, so does you grid tied system
 - ALWAYS ATTACH TO THE GRID IF YOU CAN...
 - Usually \$6K-\$8K per DC KW before incentives
- ***Off-Grid System...too expensive to hook up to utility***
 - Lots of batteries always...
 - Usually \$9K-\$12K per DC KW before incentives

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approximately 40"x65" and weighs about 50 lbs with mounts.



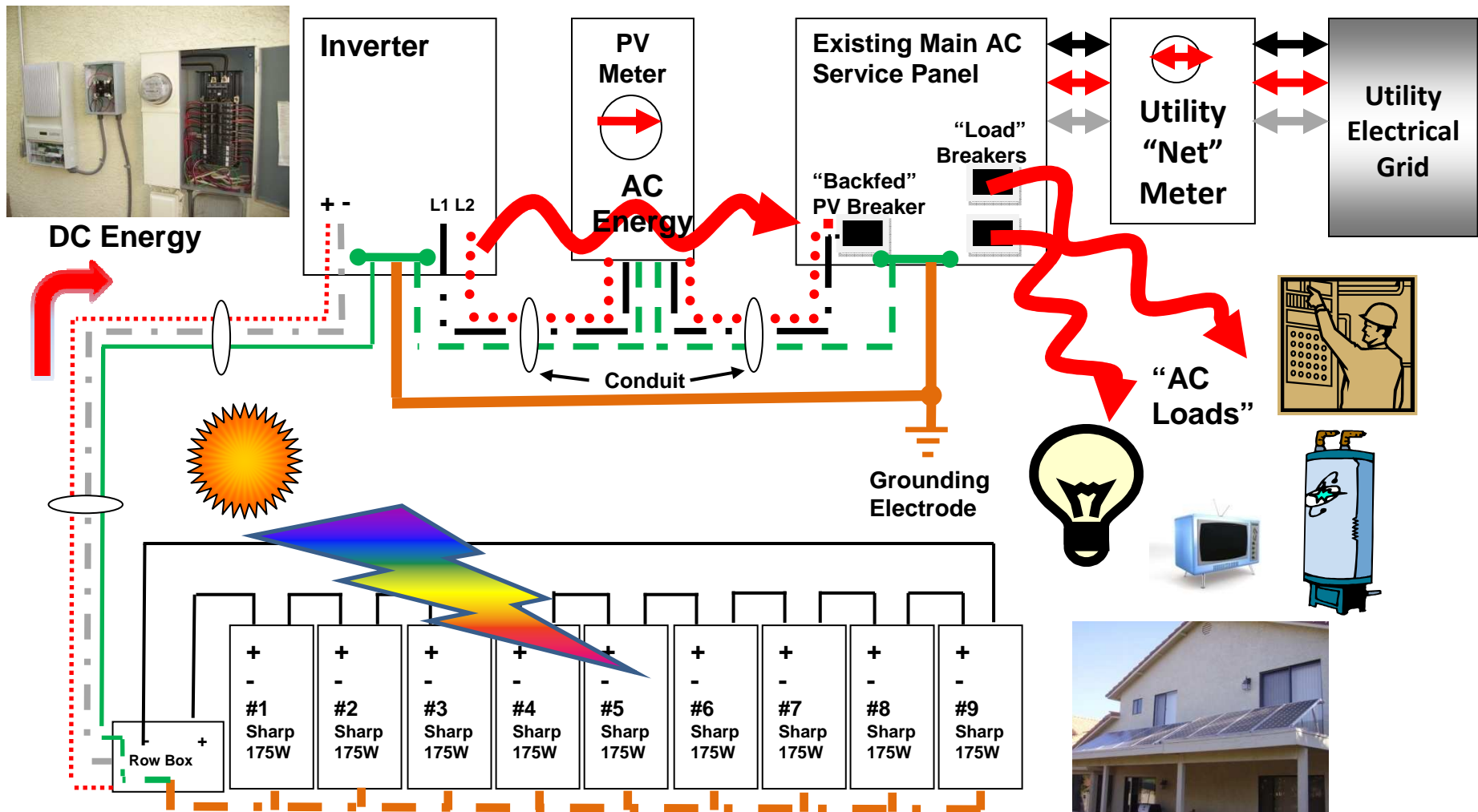
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Solar Electric Case Study – Typical Small Grid Tied System



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Solar Electric Case Study

- ***(9) 175W Sharp Panels plus Xantrex GT3.3 System***
 - TEP customer in Oro Valley, AZ; approx. \$.101/KWH rate
 - Ideal site parameters...no shading, perfect south facing orientation, inverter shaded 100% of time, breezy location
 - \$11,800 system before incentives, \$4,100 after incentives
 - \$11,800 - \$4,725 (TEP Rebate) – (\$3,000 Fed/AZ Credit) = \$4,075
 - Predicted annual output @ 70% DC-AC efficiency = 2,616 KWH
 - Actual annual output = 3,160 KWH = approx 85% DC-AC efficiency!!!
 - Predicted net ROI = $[(2,616 \text{ KWH}) \times (\$.101/\text{KWH})] / \$4,100 = 6.4\%$
 - Actual ROI 2007/2008 = $[(3,160 \text{ KWH}) \times (\$.101/\text{KWH})] / \$4,100 = 7.8\%$
 - ...AND the value of the house probably increased more than \$4,100

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How to Choose a Solar Contractor?

- 1. Experience, Education, and Training matters!**
- 2. Time in Business matters!**
- 3. Licensing and Certifications matter!**
- 4. Location matters!**

Some questions you might ask:

- How long have you been in business in Arizona?***
- What is the professional background of your qualifying party?***
- Have you had any complaints filed against you in the last 10 years? If so, can I look at your records regarding the complaint(s)?***
- Have you reincorporated in the last 10 years? If so, why?***

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Solar Priorities and Recommendations

1. Conservation...ALWAYS a smart move.

2. Solar Hot Water...a smoking good deal.

3. Solar Pool Heating...the only cost effective option.

4. Solar Electric...watching your meter turn backwards – priceless!!